Sustainable Best Management Practices for Wetland Seasonal Drainage in Response to San Joaquin River Salinity and Boron TMDLs

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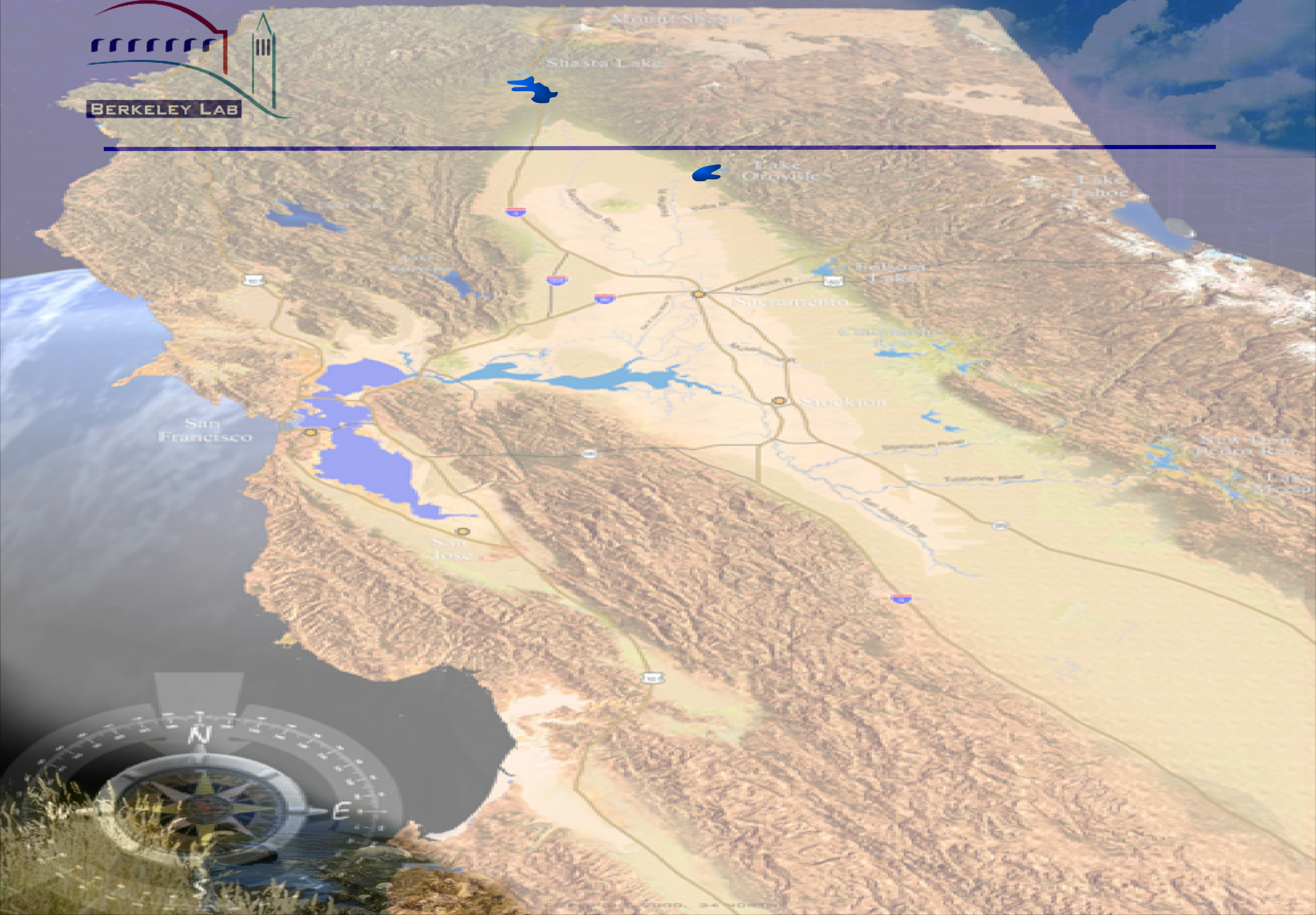
Mount Shasta
Shasta Lake
Lake Oroville
Lake Tahoe
Folsom Lake
Sacramento
Stockton
San Francisco
San Jose
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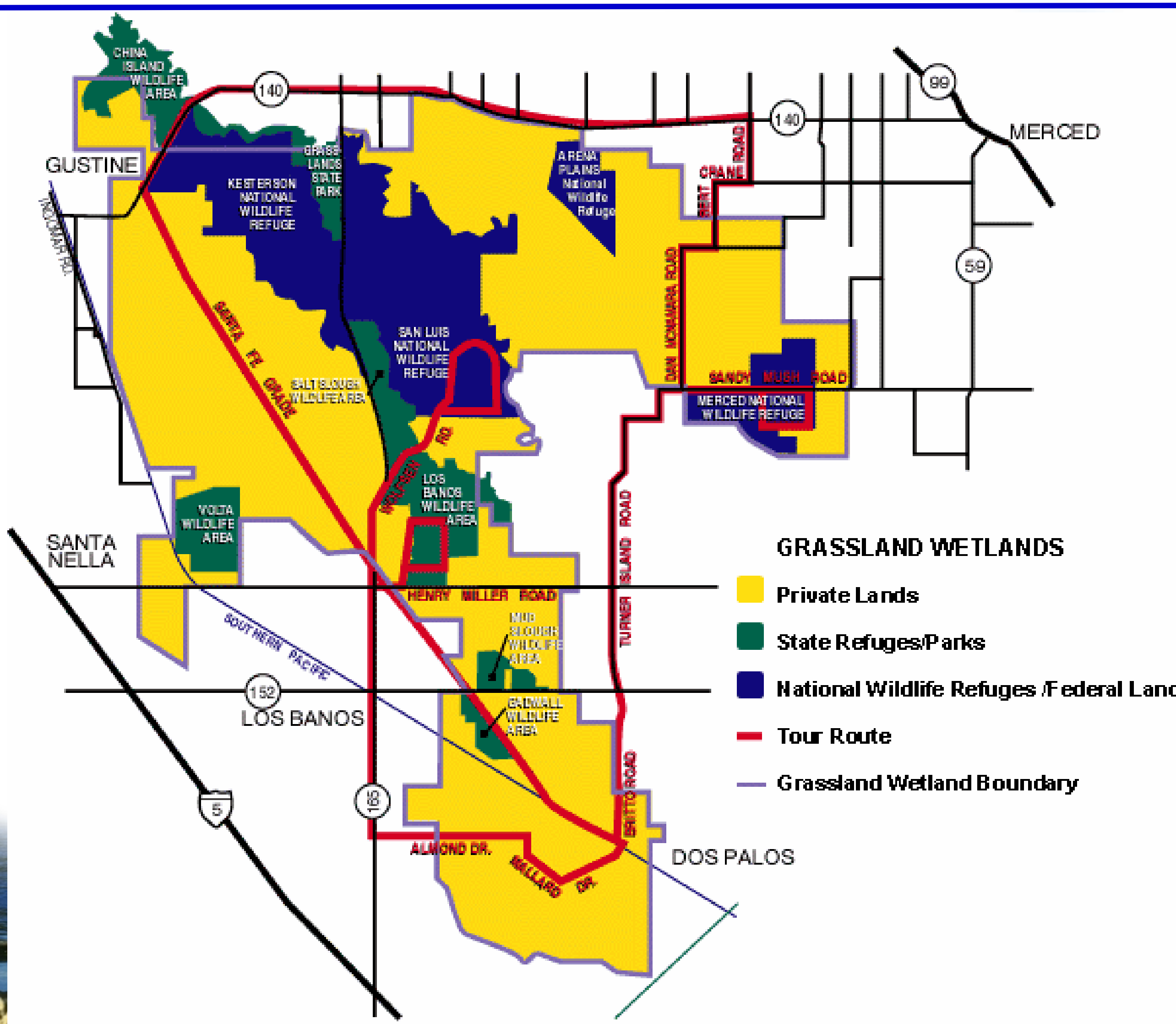
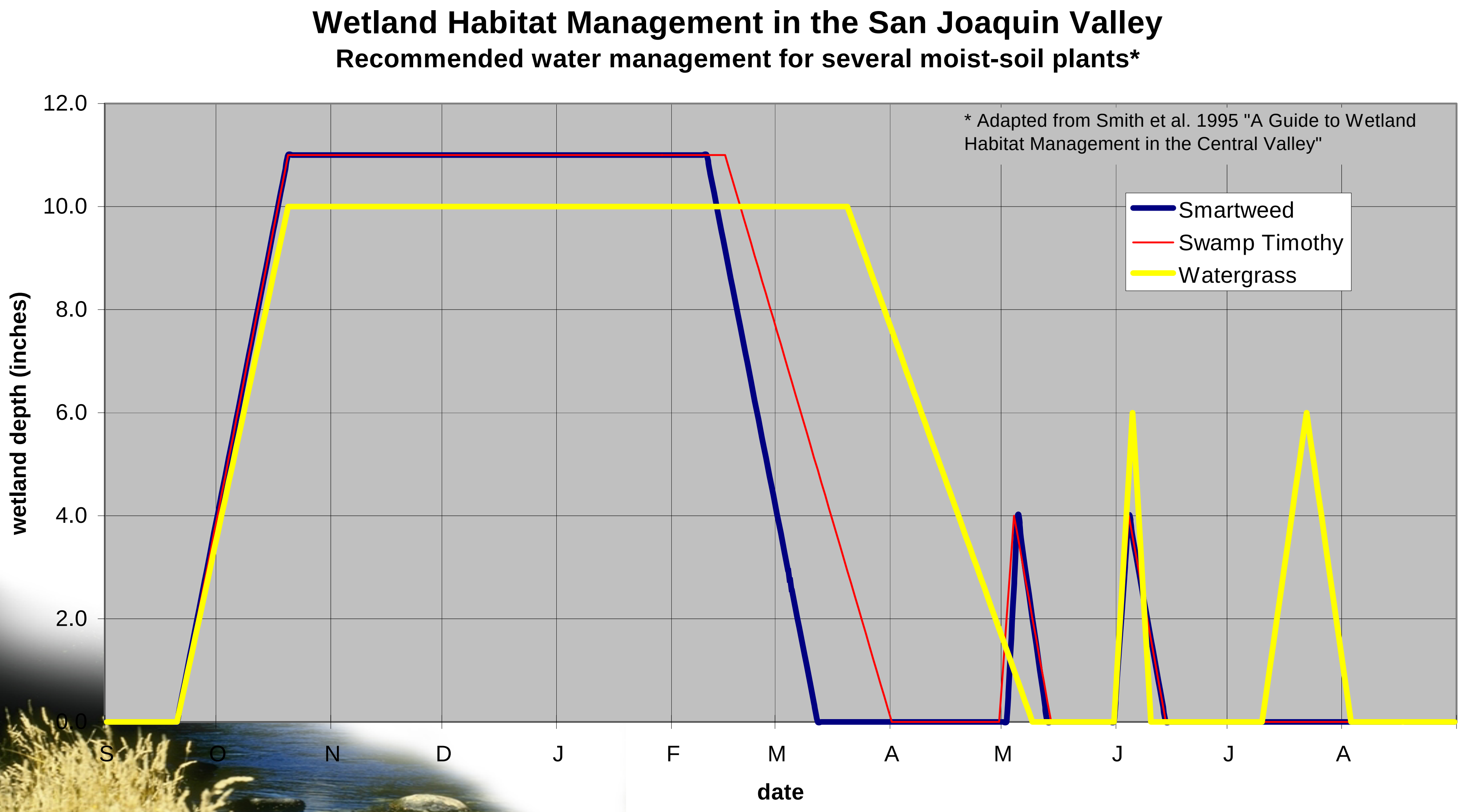
Seasonally managed wetlands in the Grasslands Ecological Area within the San Joaquin Basin



WATER MANAGEMENT FOR MOIST SOIL PLANT HABITAT



WETLAND DRAWDOWN

Wetland drawdown during spring months (Mar-April).

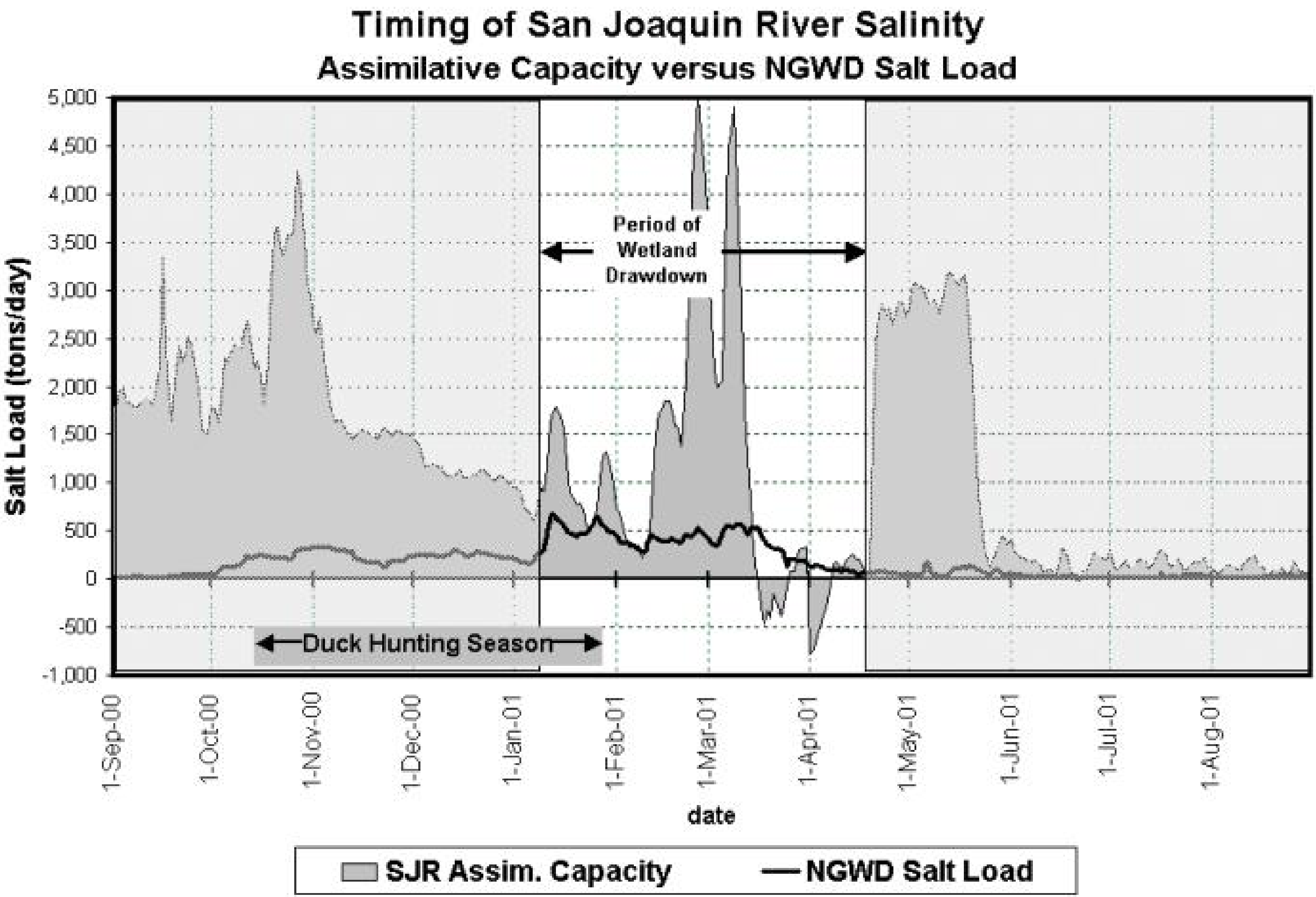
BACKGROUND – WATER QUALITY

- Selenium, boron and salt are primary constituents of concern in the San Joaquin River. Transport of salt and boron is well understood.

- Water quality often exceeds CRWQCB conc. limits
  salt : 700 uS/cm as EC April-Aug.; 1,000 uS/cm as EC Aug. – April
  boron : 0.8/1.0 ppm ; selenium : 5 ppb ; DO : 5 mg/l (6 mg/l Sept-Nov)

- Real-Time Water Quality Management utilizes SJR assimilative capacity to safely discharge contaminant loads under less onerous regulatory constraints than a strict TMDL

- Agricultural and wetland dischargers may have unrealized flexibility of operation which, with access to real-time data and a commitment to coordination - can improve compliance with SJR water quality objectives



Timing of San Joaquin River Salinity
Assimilative Capacity versus NGWD Salt Load
Salt Load (tons/day)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
-500
-1,000
Period of Wetland Drawdown
Duck Hunting Season
1-Sep-00
1-Oct-00
1-Nov-00
1-Dec-00
1-Jan-01
1-Feb-01
1-Mar-01
1-Apr-01
1-May-01
1-Jun-01
1-Jul-01
1-Aug-01
date
SJR Assim. Capacity
NGWD Salt Load

PREREQUISITES FOR A REAL-TIME WATER QUALITY TMDL

- Flow and water quality control infrastructure must be in place or under development
- Development and maintenance of a real-time drainage discharge and water quality monitoring system
- Institutions responsible for long-term stakeholder cooperation and coordination to continuously match real-time contaminant loads with assimilative capacity

OBJECTIVE / VISION

Development of a **public domain, web accessible decision support system** used to forecast San Joaquin River **assimilative capacity** and **wetland salinity loading**

….that will foster **coordination and cooperation** between wetland managers leading to increased **compliance** with State **water quality objectives**.

SALINITY MONITORING AND MANAGEMENT IN GRASSLAND ECOLOGICAL AREA WETLANDS

- Installed telemetered continuous flow, EC and temperature monitoring stations in state, federal and private wetlands
- GIS-based wetland salinity management model to assist water managers with wetland spring drawdown
- Trial implementation of real-time management concept in six paired wetland sites – treatment drawdown is delayed to coincide with VAMP period (April 15-May 15)
- High resolution satellite imagery and soil EM surveys to quantitatively assess impact of delayed wetland drawdown schedule on long term habitat health and sustainability

WETMANSIM MODEL

GRASSLAND WD - FLOODED SURFACE AREA (Seasonal Marsh)

LEVEL-2				Basin Flooding			Maintenance				Irrigation/Drawdown				
	units	Aug-Mar	Annual	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Flooded Surface Area	acres	42500		8,708	22,292	22,292	42500	42500	42500	42500	20000	2500	12000	6000	2500
ETO loss inches per month	inches			7.8	5.7	4.0	2.1	1.2	1.2	2.2	3.7	5.7	7.4	8.1	8.7
mean rainfall	inches	6.9	9.4	0.0	0.2	0.5	1.5	1.5	1.6	1.6	1.4	0.8	0.3	0.0	0.0
porosity	percent	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
pond depth	inches	9.6	6.5	2.0	7.0	12.0	12.0	12.0	12.0	10.0	8.0	2.0	0.5	0.0	0.0
fillable vadose zone porosity	inches	6.9	8.6	13.0	10.0	5.0	5.0	5.0	5.0	5.0	8.0	10.0	10.0	12.0	15.0
potential seepage loss	inches	9.6	20.6	2.6	2.0	1.0	1.0	1.0	1.0	1.0	1.6	2.0	2.0	2.4	3.0
Applied Water LEVEL-2	acre-feet	125000	125000	3500	53500	29500	21000	8000	5000	4500	0	0	0	0	0
Non-district inflow	acre-feet	27100	52100	2800	7200	1600	1800	6600	4400	2700	2100	2400	8400	7600	4500
flood wetlands	inches	53.4	53.4	8.7	28.8	15.9									
make-up water	inches	10.9	10.9				5.9	2.3	1.4	1.3					
applied irrigation	inches	0.0	0.0								0.0	0.0	0.0	0.0	0.0
end of month storage	inches			2.1	18.3	13.4	16.3	13.5	12.8	13.6	8.1	1.5			
wetland release	inches	23.0	31.1	0.1	11.3	1.4	4.3	1.5	0.8	3.6	5.7	2.4	0.0	0.0	0.0
runoff/ag spill & drainage	inches														
released/applied	percent			2%	39%	9%	73%	67%	55%						
EC of supply water	uS/cm			1,200	800	800	900	900	1,000	1,000	1,100	1,200	1,000	1,000	1,200
TDS supply water	(mg/L)	603	645	768	512	512	576	576	640	640	704	768	640	640	768
TDS wetland discharge	(mg/l)	840	1,279	1,013	725	706	751	792	855	1,037	1,938	3,692			
TDS ag runoff	(mg/l)												0	0	0
total wetland discharge	acre-feet	59,908	69,840	105	20,991	2,509	15,333	5,379	2,733	12,858	9,427	505	0	0	0
wetland discharge salt load	(tons)	68,433	121,469	144	20,711	2,408	15,659	5,795	3,179	18,134	24,849	2,536	0	0	0
Combined discharge to SJR	acre-feet	84,208	119,140	105	28,191	4,109	17,133	11,979	7,133	15,558	11,527	2,905	8,400	7,600	4,500
Combined discharge TDS	(mg/l)	739	907	777	671	630	733	673	722	968	1,713	1,276			
				total af	af/ac										
			10% LOSS	77850	1.8										
				53,292											
GWD DRAINAGE 02-03			**62,255**	**149**	**4,542**	**2,491**	**9,456**	**13,497**	**8,708**	**6,974**	**14,910**	**1,528**			
			inches	0.2	2.4	1.3	2.7	3.8	2.5	2.0	8.9	7.3			

HUMAN FACTORS IN ADOPTION OF REAL-TIME MANAGEMENT

- Recognize institutional constraints of participating wetland entities : Federal and State agencies have autonomy over wetland management decisions : private wetland managers answerable to private duck club boards
- Private entities that are not as well funded as State and Federal agencies. Incentive programs could be combined with existing habitat programs as agents of change.
- Collaborations with regulatory entities (CWRQCB) to develop interim salt load targets - creating a transition period for wetland management to learn by doing and improve drainage salt load scheduling incrementally (adaptively)

WETLANDS MANAGED DRAWDOWN IMPACTS MONITORING

- Wetland managers are making progress toward implementation of real-time management to improve SJR water quality. …*but need to understand what impact*, *if any*, *changes in management practices would have on habitat quality and sustainability of the biological resource*

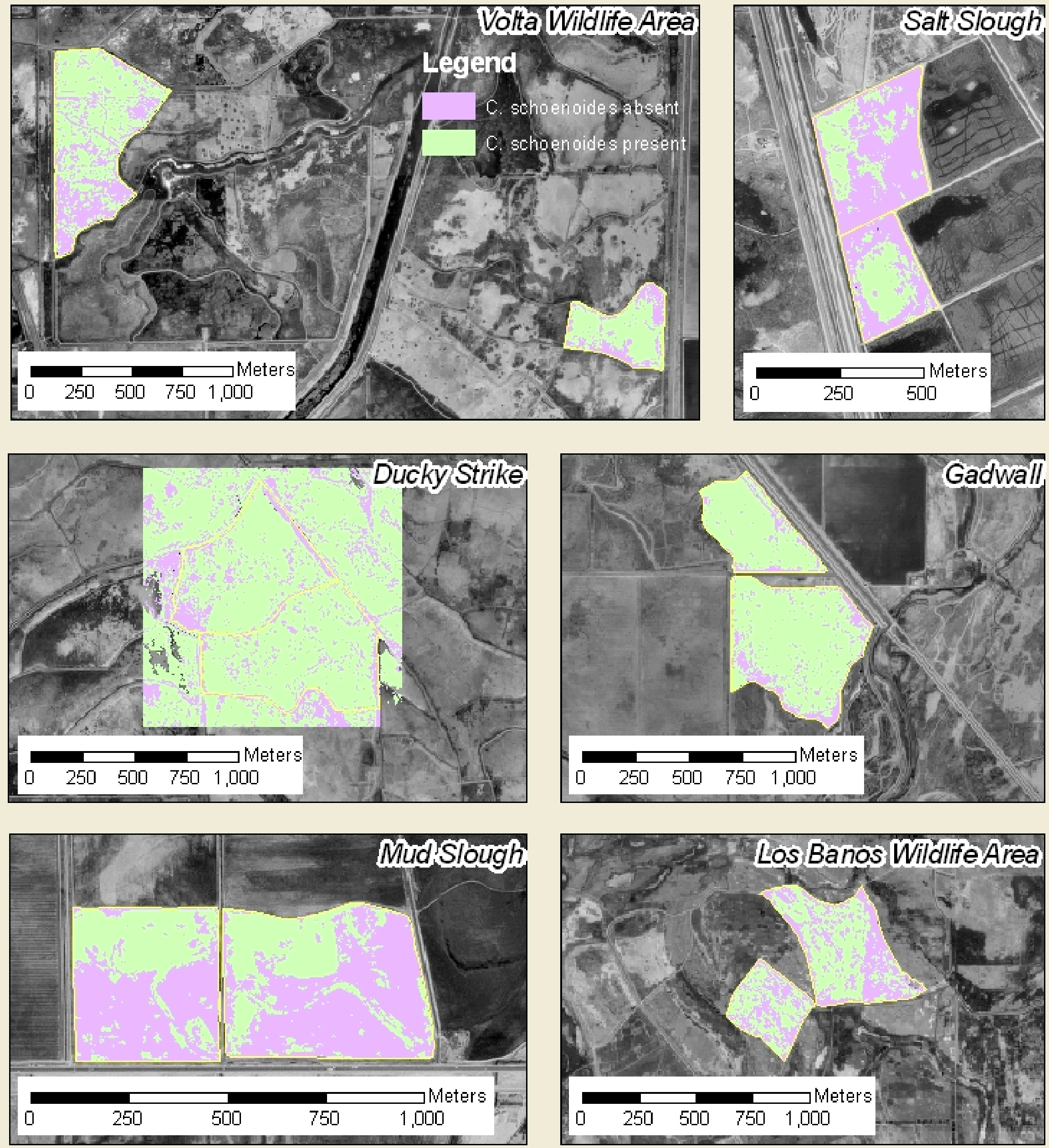
- Accurate soil salinity and vegetation maps are important tools for evaluating water needs for wetlands, developing Best Management Practices and documenting trends in habitat quality. Need to be supplemented with biological monitoring

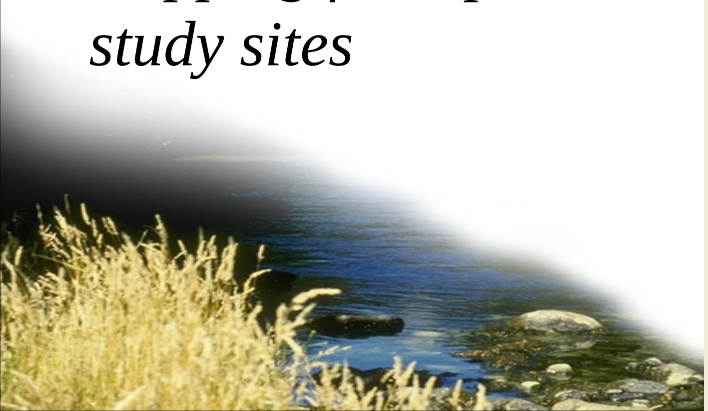
Swamp timothy presence/absence preliminary image classification
Los Banos Wildlife Area 2006

SWRCB/CALFED Modified Drainage Implementation Project :

Results of 2006 swamp timothy mapping for 6 paired study sites

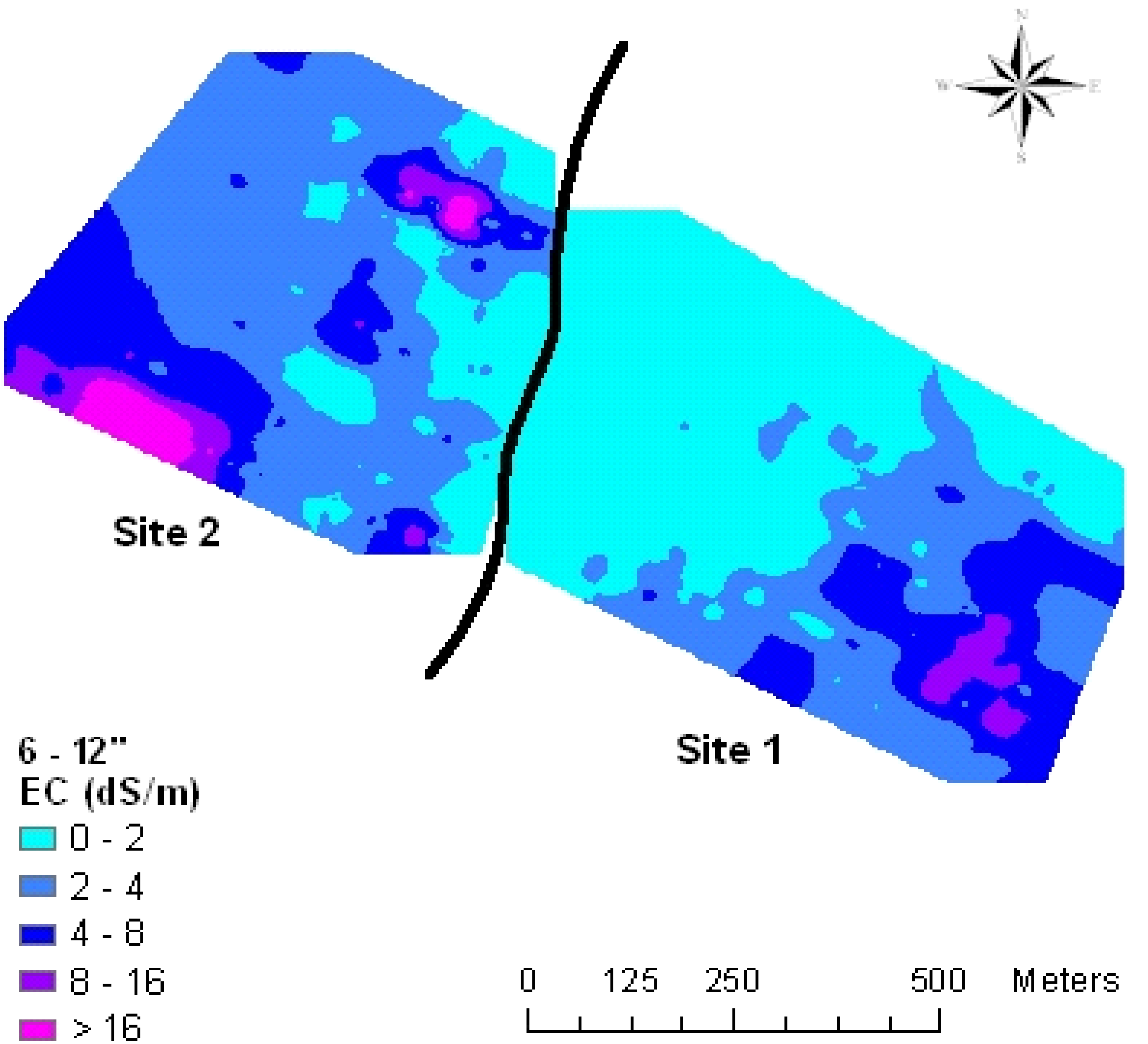
Estimated Presence / Absence of Crypsis Schoenoides
Los Banos, California - 2006





GEONICS EM-38 DUAL MODE METER FOR SOIL SALINITY MAPPING

SOIL SALINITY ESTIMATED AT 6-12" DEPTH AT TWO SITES IN THE SAN LUIS NWR IN 2004



SUMMARY

- Real-time salinity management is only real-option available to San Joaquin Basin seasonal wetlands to meet EC objectives since TMDL drainage load allocations will be insufficient for habitat sustainability
- Real time water quality management will require integration of data acquisition, processing, model forecasting, information dissemination and decision support
- Full TMDL compliance required in 14 years – major challenge for cooperation and coordination between State and Federal refuges and the 160 privately owned duck clubs in the watershed